# Measurement, Monitoring, and Verification

## **NETL** (6 projects)

- Comprehensive Monitoring Techniques
- Determine integrity of wellbore cement and how effective it is in preventing leakage
- Computed Tomography imaging for CO<sub>2</sub> sequestration and EOR
- Permanent Storage:
  Enhancement of Seals
- Experiments, simulations, and field projects
- Lab studies for geologic sequestration

# **Technology Target**

- Indirect monitoring technology acceptable to permitting agency
- Direct CO<sub>2</sub> monitoring to detect leaks
- Reservoir monitoring test
- Demonstrate advanced videography for accurate remote estimates carbon inventories

#### **MMV Outcomes**

- · Understanding of equilibria between multi component gases, oil, and water
- Reliable monitoring and verification technology for CO<sub>2</sub> storage sites
- Computer simulation model to effectively monitor CO<sub>2</sub> depleted oil reservoirs, abandoned coal mines, and saline aquifers
- · Instrumentation and measurement protocols for carbon inventories in soils, forests, and geologic formations

#### SNL/LANL

 Computer simulation model for field test including measurement of fluid pressure changes for depleted oil reservoirs

## Natural Resources Canada

Weyburn Project

## **LANL**

- Applied terrestrial sequestration partnerships
- CO<sub>2</sub>-water-rock interactions and integrity studies
- Development of novel monitoring tools

### BP

Risk assessment and monitoring tools development

#### Winrock Int

• Detect changes in forest carbon sequestration

## **Albany Research Center**

Enhancement of natural seals

#### LBNL

- ZERT: CO<sub>2</sub> storage in sedimentary basins
- Modeling of hydrologic impact
- CO2SINK
- Geophysical monitoring tools/coalbeds

## **University of Houston**

• 3-D seismic attribute technology

## Geo-Seq

LBNL – Seismic & EM Imaging LLNL – Electrical Imaging

ORNL – Isotope Tracers

# Nature Conservancy

 Demonstrate and refine the tools and methodologies for cost-effective, verified measurements of the long-term potential of various carbon sequestration and land use emissions avoidance strategies

#### <u>BNL</u>

- Non-invasive soil carbon scanning system
- Long-term monitoring of CO<sub>2</sub> leaks

# **Ohio State University**

Reclaimed mined soils of Ohio

#### **Ohio State University Research Foundation**

 Assess Fossil Fuel and recent carbon pools in reclaimed mine soils

## **PNNL**

- ZERT
- Fossil energy technology strategy

## LLNL

- Geoscience technology for zero emission plants
- Fault geomechanics and CO<sub>2</sub> leakage

## **University of Kansas**

- Construct database to evaluate geological locations and characteristics of CO<sub>2</sub> sources
- Modeling and assessment

#### MII

- Development of a carbon management GIS for US
  Cal Tech
- Develop instruments that will measure and monitor CO<sub>2</sub> emissions for geological sequestration sites
   Battelle Columbus

• Develop an improved understanding of the geologic framework for the deep geologic formations

# **Geologic Survey of Alabama**

Models for risk assessment

## University of Kentucky Research Foundation

Measure and document rates of surface gas flux

# **Montana State University**

Risk assessment and MMV

## **Physical Optics Corporation**

• Early remote risk assessment technology

## **Los Gatos Research**

· Gas analyzer for MMV applications

